SCR Performance Improvement From US Coal Quality Evaluation.

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Coal is perhaps the most significant parameter in the application of SCR technology for NOx control. The current US experience is insufficient to respond to the recent demand of this technology to meet the NOx SIP rule. The global experience lies in Western Europe and Japan, which, although useful, can not be completely extrapolated to all the US coals.

The coal quality parameters influencing the design and operation of SCR units have been reported. However US Utilities may find an improved understanding of the different aspects of Eastern and Western Coals helpful in the retrofit application of this technology.

The main coal properties impacting SCR performance in terms of catalyst life, airheater performance and flyash quality are - sulfur, arsenic, alkali and alkaline earth based constituents, ash burden, chlorine, fluorine and unburned carbon in flyash. The quality of the US bituminous coal is significantly different from that of the sub-bituminous coal. For example, almost 50% of the coal East of Mississippi contain 2% or more sulfur. The western sub-bituminous coal particularly of the Powder River Basin has different mineral constituents and distribution from those of the eastern bituminous coal.

High sulfur is associated with high arsenic level, the latter being present with pyrite, the major source of sulfur in coal.

The mineral matter in most bituminous coal largely consists of alumino-silicate clay species besides pyrites and quartz. The sub-bituminous coal has high level of sodium, calcium and to a certain extent magnesium, majority of which are present in the coal matrix. The pyrite level of western coal is also significantly low and hence these coals have low sulfur content when compared to bituminous coal. Western coals have consequently lower arsenic content. The alkali contents of the PRB coal are however

higher than those of bituminous coal. Some of the alkalis especially the sodium compounds are present in water-soluble form. These as well as coal bound calcium and magnesium compounds are consequently liberated readily in the furnace. These give rise to the formation of deposits on the catalyst surface and on the airheater. The high sulfur level of bituminous coal gives rise to higher levels of sulfur trioxide formed by the vanadium oxide catalyst causing corrosion of the airheater surfaces.

The remedial/mitigating measures to improve SCR performance and airheater pluggage/ corrosion include - combustion optimization (in terms of coal fineness, coal/air ratio and distribution), addition of limestone in the furnace to i) reduce the SO3 concentration of flue gas entering airheater and to ii) form solid compounds of arsenic thereby minimizing gaseous arsenic oxide, the main poison, entering catalyst chamber. Airheater deposit formation can also be minimized by a suitable blend of coal.

The coal quality parameters have also significant impact on catalyst composition, pore size, pitch and volume and thus the catalyst life.

The coal quality aspects that should be studied in-depth besides the conventional properties include - arsenic, quantification of the organically bound calcium/magnesium, chemical fractionation to identify water soluble and mineral-bound alkalis, coal mineralogical analysis and phase studies of the deposits of the airheater. These will greatly assist in achieving the desired NOx removal efficiency and maximizing catalyst life.

Use of additives to minimize free lime content in flue gas and to reduce unburned carbon in fly ash also merits consideration.